PRC Environmental Management, Inc
1099 18th Street
Suite 1960
Denver CO 80202
303 295 1101
FAX# 303 295 2818

prc
Planning Research Corporation

ROCKY FLATS PLANT
Jefferson County, Colorado

TECHNICAL REVIEW OF PHASE II RI/FS WORK PLAN FOR OPERABLE UNIT NO 2

Prepared for

U S ENVIRONMENTAL PROTECTION AGENCY
Region VIII Federal Facility Remedial Branch
Denver, Colorado

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Prepared by	PRC Environmental Management Inc (Jim Wulff Jeff Reichmuth Terry Ruiter)
Telephone No	303/295-1101
EPA Primary Contact	Nat Miullo
Telephone No	303/294-7434

1.0 INTRODUCTION

The U S Environmental Protection Agency (EPA) requested that PRC Environmental Management, Inc (PRC) review the "Phase II Remedial Investigation and Feasibility Study (RI/FS) Work Plan (RI work plan) for the 903 Pad, Mound, and East Trenches Areas" at Rocky Flats PRC reviewed this document under the Technical Enforcement Support (TES) XII contract, Work Assignment C08006

The following review comments are keyed to the applicable section of the document PRC reviewed the RI work plan for compliance with the "Federal Facility Agreement and Consent Order (IAG)," and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) statues, regulations, and guidance PRC also determined whether the RI work plan has incorporated or addressed "Tetra Tech Comments on the Phase II RI Sampling Plan for 903 Pad, Mound, and East Trenches Areas (RI Sampling Plan comments) " It should be noted that the site characterization in the RI work plan is based largely on the "Draft Background Geochemical Characterization Report (DBGCR)", dated December 1989 A complete analysis of the data collected and statistical procedures utilized in the DBGCR is beyond the scope of this review Typographical and editorial errors have not been addressed

2 0 TECHNICAL COMMENTS

1 Section 2.3 This section presents the results of the Phase I RI soil sampling program Raw data are presented in Appendix A Analytical results for uranium 235 (U-235) are not reported in Appendix A, nor are they mentioned in Section 2 3 The ratio of U-235 to U-238, when compared against a background ratio, can indicate the presence of uranium that is enriched as a result of uranium processing activities Table 2-4 on page 2-21 shows that U-235 data have been analyzed and reported as part of the geochemical characterization of background geologic materials The soil concentrations of U-235 are essential information and should be provided in the RI work plan If this information cannot be reported, an explanation should be provided in Section 2 3

2 Section 2.3, Table 2-4, Page 2-21. This table infers that all tolerance intervals for radionuclides in the Rocky Flats alluvium were calculated from a sample population of 70 However, Table 4-35 of the DBGCR lists the number of samples used to derive the tolerance interval for Americium 241 as 21 This discrepancy should be resolved

Table 2-4 also states that the data required to calculate tolerance intervals for Americium 241 in colluvium, weathered claystone, and weathered sandstone have not been received

This information must be included in the final RI Phase II work plan, since Americium 241 is one of the primary radionuclide contaminants of concern, and the IAG states that RI work plans for each operable unit (OU) are to assure each site is fully characterized

3 Section 2.3, Table 2-6, Page 2-27 The column headings "percent of surface samples above background" and "percent of subsurface samples above background" are vague Depth intervals should be specified for these headings

4 Section 2.3.2, Page 2-28, Paragraph 1 This paragraph states that concentrations of uranium, strontium, and cesium that occur above background levels represent natural variations outside calculated tolerance intervals However, page 2-13 of this document states "the boundary of background variability was quantified through the calculation of tolerance intervals assuming a normal distribution " Unless "background variability" is defined differently than "natural variability," these two statements contradict each other Furthermore, the determination that these concentrations represent natural variations is based partly on the fact that "the concentrations of these radionuclides were within a factor of approximately two of the upper limit of their background tolerance intervals This criterion for determining natural variation outside calculated tolerance intervals is not adequately explained or referenced

5 Section 2.3.2.1, Page 2-34, Paragraph 3 It seems premature to postulate radionuclide contamination at Trench T-2 can be attributed to wind dispersal from the 903 Drum Storage Site Large composite soil samples, such as the 0- to 9-foot sample taken from BH25-87, do not allow for analysis of soil at specific depths Also, Figure 1-5 shows that Trench T-2 (SWMU 109) contains drums, and section 1 4 1 3 of this document states that Trench T-2 was used for the disposal of flattened drums contaminated with uranium and plutonium (page 1-24) This section also states that Trench T-2 is 5 feet deep Thus the 0- to 9-foot sample cited on page 2-34 as evidence that radionuclide contamination is concentrated at the surface, and therefore arrived via wind dispersal, is unsupported It is equally likely that contamination could also have occurred via the downward and downgradient migration of radionuclides from buried drums The use of large composite soil samples could also underestimate radionuclide concentrations by diluting a highly concentrated zone with a much greater volume of lightly contaminated soil

6 Section 2.3.2.2, Page 2-36, Paragraph 1 This discussion does not appear to address the source characterization of the Oil Burn Pit No 2 site (SWMU 153) The only boreholes referenced (BH35-87 and BH36-87) are adjacent to Trench T-1 Furthermore, the

Mound Site (SWMU 113) lies between SWMU 153 and these boreholes Figure 2-1 does not depict any boreholes adjacent to SWMU 153 Thus it is not clear how the source characterization for SWMU 153 was achieved

7 Section 2.3.2.2, Page 2-36, Paragraph 2. It seems premature to postulate that radionuclide contamination at Trench T-1 can be attributed to wind dispersal from the 903 Drum Storage Site Large composite soil samples, such as the 0- to 12-foot sample taken from borehole BH35-87, do not allow for analysis of soils at a specific depth Also, Figure 1-5 shows that Trench T-1 (SWMU 108) is filled with drums Section 1 4 2 2 of this document states that Trench T-1 contains approximately 125 drums filled with approximately 25,000 kilograms of depleted uranium and plutonium chips coated with a small amount of lathe coolant. Furthermore, two drums containing uranium and plutonium contaminated oil and oil sludge were found near Trench T-1 in 1968 Since the drums were unearthed during weed cutting activities and "inadequately covered with fill materials," it would seem these drums may have been located near the surface Therefore, the 0- to 12-foot sample cited on page 2-36 as evidence that radionuclide contamination arrived via wind dispersal is unsupported Soils could also have been contaminated by the downward migration of radionuclides from buried drums

8 Section 2.4, Page 2-69, Paragraph 2 The statement is made that Table 2-12 identifies parameters for which analyses should be performed during Phase II and their respective minimum acceptable detection limits Table 2-12 shows the maximum concentrations of contaminants in ground water in the vicinity of the 903 Pad Mound and East Trenches and the applicable or relevant and appropriate requirements (ARARs) for those contaminants It does not show minimum acceptable detection limits ARARs are not to be considered as such The text and the table should be corrected

9 Section 2.5, Table 2-13, Page 2-71 This table provides general response actions and corresponding potential component remedial technologies to be evaluated during the FS for the 903 Pad, Mound, and East Trenches areas When considering on-site treatment/backfill technologies (see Associated Remedial Technologies column), solidification/stabilization and biodegradation should be presented as options In-situ contaminated soil treatment technologies to be considered in the FS should include vitrification and biodegradation Additionally, coagulation and precipitation technologies should be considered for treatment of ground and surface water (for example, addition of aluminum sulfate or ferric chloride for the removal of metals)

10 Section 2.5, Table 2-14, Page 2-72 This table provides the specific data requirements necessary to evaluate the identified technologies It should be made clear that a full suite of inorganic and organic analyses is necessary in order to adequately evaluate technologies other than thermal treatment technologies

These data needed in order to evaluate the technical feasibility and cost effectiveness of thermal technologies can be obtained by performing an ultimate analysis on contaminated soil In addition to an ultimate analysis, an analysis to determine the higher heating value will be necessary (the term "BTU content" is inconclusive)

11 Section 3.1, Page 3-2, Paragraph 1. Conclusion 8 states that wastes have been removed from the 903 Drum Storage Site It should be noted that approximately 5,000 gallons of waste oil containing 86g of plutonium have been released into the soils below the 903 Drum Storage Site (RI Work Plan, page 1-22) The wastes may have been removed but waste impacted soils apparently still remain

12 Section 3.1, Page 3-2, Paragraph 1 A further definition of the extent of radionuclide contamination will require sampling small, discrete intervals from excavated trenches or using borehole geophysics (gamma logs, scintillometers) where trenching is not possible Both methods should be used when sampling locations are adjacent to SWMUs where radioactive materials have been stored or disposed Grab samples from trench walls will give quantified concentrations of specific radionuclides Borehole geophysical methods can provide a continuous analysis of radionuclide contamination throughout the sampled zone

13 Section 3.2, Table 3-1, Page 3-3 This table summarizes the objectives and the associated data needs of the Phase II RI One objective specified in Table 3-1 is the characterization of the nature and extent of contamination According to this objective, the horizontal and vertical extent of surficial radionuclide soil contamination due to wind dispersion will be determined This objective should be expanded to include the horizontal and vertical extent of inorganic and organic contamination In addition, the extent of radionuclide contamination caused by events other than wind dispersion (for example, drum leakage and dumping) should be determined

14 Section 3.2, Table 3-2, Page 3-7 Detection limits listed in this table do not correspond with many of the detection limits given in Appendix 9 of 40 CFR Part 264 (ground-water monitoring list) Appendix 9 lists practical quantitation limits (PQL) of 0005 mg/l for tetrachloroethene and 002 mg/l for vinyl chloride both of which can be achieved with

EPA method 8010 The PQLs would allow the ARAR listed for vinyl chloride in Table 2-3 (002 mg/l) to be applied and would require the ARAR listed for tetrachloroethane in Table 3-2 (.005 mg/l) to be replaced by the Colorado Department of Health ground water standard (.0008 mg/l)

15 Section 4.1, Page 4-1. Section 4 1 specifies various tasks to be performed during the RI As specified in "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA", health and safety protocols should be identified in the preparation of a RI This activity should be included in Section 4 1

16 Section 4.1.3, Page 4-2, Paragraph 1. This section states that " ..the Phase II RI/FS field investigation is designed to meet the objectives outlined in Section 4 0 " An outline of these objectives is not provided in Section 4 0 It is suspected that a typing error was made, and Section 4 0 should read Section 3.0 in this statement

17 Section 4.1.6.1, Page 4-9, Paragraph 1 This section states that for the risk assessment " all contaminants at Operable Unit No 2 will be considered unless the following criteria are met for their deletion.

- Determination that a chemical has not been detected above risk based detection limits,
- Environmental fate information which shows that exposure will not occur, or
- A low frequency of occurrence (less than 10 percent) in environmental media "

It is not clear if all three criteria must be met or if just one of the three criteria must be met to consider the deletion of a contaminant In addition, the term "risk based detection limits" should be defined

The meaning and rationale for the third criterion are not easily understood and should be explained Although a contaminant may be detected infrequently, its concentration could be high enough to warrant remediation

18 Section 4.1.6.1, Page 4-11, Paragraph 1. The statement that exposure to a contaminant might result in an "excess cancer risk for noncarcinogenic health effects" is not understood and should be explained If a contaminant has been identified as noncarcinogenic, it should not have an effect on cancer risks in risk assessment calculations

19 Section 4.1.6.2, Page 4-13, Paragraph 4 This discussion of the environmental evaluation states that the investigation will include the collection of several types of organisms to determine if there is bioaccumulation of contaminants in the vicinity of OU2 The remainder of the discussion does not describe the procedures used when determining if bioaccumulation has occurred

20 Section 4.1.6.2, Page 4-14, Paragraph 3 The text discusses biomarkers The discussion of population-ecosystem density, diversity, or nutrient cycling as measured in individual organisms does not indicate an understanding of the methods used to evaluate ecological systems, however This, in turn, suggests that biomarkers are not well understood The discussion should be rewritten with an explanation of the procedures to be used specifically for the Rocky Flats evaluation

21 Section 4.1.6.2, Pages 4-13, 4-14 The text discusses the need for field and laboratory activities which would determine the effects of contaminants from the 903 Pad, Mound and East Trenches on the area's flora and fauna The discussions of field activities in Chapters 3 and 4 do not indicate even the possibility of field work for biological systems If ecological field activities are to be part of the Phase II RI work, they need to be described in the work plan The environmental risk assessment should be described based on actual projected Phase II activities

22 Section 4.1.7, Page 4-15 According to this section, treatability studies/pilot tests will focus on removal of radionuclides from water and soil Remedial technologies for the removal of organics and inorganics should also be considered for treatability studies

23 Section 5.1 This section details the sampling locations proposed for the Phase II investigation and provides the rationale behind the selected sampling locations The alluvial monitoring well array depicted in Figure 5-1 appears to have incorporated most of the recommended additions proposed by Tetra Tech in the RI Sampling Plan comments However, the adequacy of the well depths and screen intervals proposed in Table 5-1 is difficult to evaluate due to insufficient background data

Only one potentiometric surface map is included with the RI work plan, and the time of year is not given Water level data exists in Appendix E of the Phase I RI, but only fall and winter sampling events are included for 1987 and pre-1986 monitoring wells Data for the 1986 monitoring wells do include sampling dates in the high runoff/high saturation season (May through June), but few of these wells are located adjacent to SWMUs in OU2, none in the 903 Pad area Furthermore, Section 5 0 does not state

whether monitoring wells are to be drilled to the top or the base of the weathered bedrock. Therefore, the following recommendations for screened intervals are given in terms of "feet above bedrock" Whether these recommendations agree with Table 5-1, or represent a departure from it, may depend on whether the anticipated screened intervals given in Table 5-1 include or exclude the weathered bedrock

- Based on projected potentiometric and known bedrock contours, it is not anticipated that a screened interval greater than 5 feet above bedrock will be necessary in the 903 Pad area
- Figure 2-3 shows that the bedrock contact beneath the Mound Site is less than 10 feet deep Proposed well depths and screened intervals for monitoring wells 16-90 and 17-90 appear to be overestimated
- Known bedrock contours indicate the presence of a paleochannel (RI work plan, page 2-3) Bedrock contours indicate that proposed wells 21-90 and 22-90 in the north trench area, and 25-90, 26-90, 28-90, and 30-90 in the south trench area, will intercept the paleochannel. Existing potentiometric data from nearby wells in the paleochannel indicate that characteristic saturated thicknesses in the alluvium range from 5 to 0 feet, with a seasonal maximum of 16 feet in well 41-86 located about 350 feet east of the easternmost trenches It is not anticipated that screened intervals greater than 20 feet above bedrock will be necessary in the paleochannel alluvium
- The remainder of the proposed monitoring wells in the East Trenches area (wells 18-90, 19-90, 20-90, 23-90, 24-90, 27-90, 29-90) appear to be outside of the paleochannel Potentiometric data from wells outside of the paleochannel indicate that the water table is typically at or below the bedrock surface It is not anticipated that screened intervals greater than 10 feet will be necessary for wells in this area
- Proposed wells 32-90 and 33-90 appear to intercept the paleochannel Consequently, both the well depth and screened intervals given in Table 5-1 may have been underestimated

Finally, it should be noted that the RI work plan does not incorporate Tetra Tech's recommendation (RI Sampling Plan comments) for constructing well clusters A well cluster should consist of 3 wells: one screened at the water table in the alluvium, one screened in weathered bedrock, and one screened in unweathered sandstone bedrock It is assumed that the deepest well will be addressed in the Phase III work plan for the bedrock ground water investigation It has been previously mentioned that the RI work plan does not specify whether weathered bedrock is to be addressed in this phase of the investigation It will be appropriate to address the well cluster approach when the completion of wells in the weathered bedrock is proposed Promising locations for well clusters can be identified based on Figures 2-3 and 2-4 and water level data from the Phase I RI The most appropriate locations for well clusters are locations where the paleochannel alluvium is directly contacting bedrock sandstones Existing wells 42-86 in

the northern trenches and 41-86 and 32-87 have characteristic saturated thicknesses of 5 to 10 feet These wells are believed to be located in the paleochannel Seismic reflection data that should locate and characterize bedrock sandstones may be released soon (RI work plan, page 2-6) The addition of this data should allow tentative well cluster locations to be identified

24 Section 5.1.1, Page 5-1, Paragraph 2 This paragraph states "all drilling, sampling, and well installation will follow the Rocky Flats Plan Environmental Restoration Program Standard Operating Procedures (SOP)" These SOPs have never been approved by the EPA The SOPs have been briefly reviewed in RI Sampling Plan comments (pages 32-35) Many deficiencies and inconsistencies within the SOPs have been noted in that document Although new SOPs are being prepared, the absence of approved SOPs requires that all procedures related to drilling, sampling, and well installation must be included in the appendices to the RI field sampling plan or in the quality assurance project plan (QAPjP)

25 Section 5.1.1, Page 5-10, Paragraph 1 Weathered bedrock that underlies saturated alluvial sediments is likely to be saturated also, thereby precluding the collection of bedrock cores that are suitable for chemical analysis of bedrock material This is especially true when the weathered bedrock consists of sandstone Saturated sandstone has been found directly beneath surface materials in bedrock monitoring wells 9-87BR 12-87BR 23-87BR and 25-87BR, it has been found near the bedrock/alluvium contact in bedrock monitoring wells 62-86BR, 11-87BR, 14-87BR, and 36-87BR (Proposed Interim Measures/Interim Remedial Action Plan and Decision Document - 903 Pad, Mound and East Trenches Areas, page 2-12) All of these wells are adjacent to or downgradient of SWMUs in each of the constituent areas of OU2 (well 12-87BR is within SWMU 155) Weathered bedrock consisting of claystone may also be saturated Weathered claystone in the Arapahoe formation at Rocky Flats is characterized by "mild to intense fracturing" (Phase I RI, page 5-6) These fractures may allow the weathered claystone to become saturated beneath overlying saturated alluvium

26 Section 5.1.1.1, Page 5-12, Paragraph 2 The Gas Detoxification Site (SWMU 183) is a potential source of contamination within the 903 Lip site which has not been characterized in the past No boreholes have been drilled adjacent to this SWMU and none are planned Section 1 4 1 5 provides a brief description of the detoxification activities that transpired at this site However, it does not identify the neutralizing agents used, nor does it mention how the rinseate was disposed A borehole should be drilled in

or adjacent to this SWMU to confirm that contamination has not occurred as a result of gas detoxification activities.

27 Section 5.1.1.2, Page 5-14, Paragraph 1: This paragraph states that "no additional boreholes are proposed for source characterization of this site" (Oil Burn Pit No 2 - SWMU 153) Figure 2-1 does not show any boreholes adjacent to this site nor is there any mention of site characterization data specific to SWMU 153 (refer to comment 6) Due to the high volumes of radioactive materials that were disposed of at this site (1,082 drums of oil containing uranium), a stronger effort should be made to characterize this site and confirm that all contamination has been removed. A borehole should be drilled into SWMU 153

This paragraph also refers to an additional monitoring well downgradient of SWMU 153 that is discussed in Section 5 1 2 2 Available potentiometric data indicates that this proposed well (48-90) may be cross-gradient to SWMU 153 and may not intercept a plume migrating downgradient from this potential source Well 48-90 would be located directly downgradient of and adjacent to the Mound Site (SWMU 113) This well would likely intercept contaminated ground water migrating from SWMU 113, making it impossible to differentiate contaminated ground water from SWMU 153. Well 48-90 should be shifted approximately 100 feet west of its proposed location, which will place it directly downgradient of SWMU 153 If a borehole is not drilled into SWMU 153 or if a borehole is drilled into SWMU 153 and detects contamination, the relocation of well 48-90 (as described above) should be required

28 Section 5.1.1.2, Page 5-14, Paragraph 2. This paragraph states that of the two possible Pallet Burn Site locations, the westernmost is within the PSZ fence and inaccessible to drilling, therefore no additional boreholes will be drilled there This statement contradicts Section 2 3 2 2 (page 2-37, paragraph 1) which states "additional soil samples will therefore be collected from borings at both possible Pallet Burn Site locations during Phase II activities " Boreholes should be drilled into both sites to determine the exact location of this SWMU as well as its level of contamination If the boreholes indicate that the westernmost site is contaminated, then proposed monitoring well 49-90 should be placed directly downgradient of the westernmost site

29 Section 5.1.1.3, Page 5-15, Paragraph 1. This paragraph states that no boreholes will be drilled into Trench T-10 because it is filled with barrels However, Figure 1-5 shows that Trench T-10 (SWMU 11 7) does not contain barrels If barrels exist in Trench T-10, they should be depicted in Figure 1-5 and boreholes and monitoring wells should be drilled

adjacent to the trench If the barrels do not exist in Trench T-10, boreholes and monitoring wells should be drilled in Trench T-10, unless an overriding safety concern exists and is stated in the RI Phase II work plan

Figure 1-5 also shows that Trench T-4 does not contain barrels Although two boreholes are already proposed for Trench T-4, they are to be located at either end of the trench An additional borehole in the center of the trench would, together with the two proposed boreholes, provide details on the construction of the trenches (an objective stated in this paragraph) Furthermore, Trench T-4 appears to be the source of the highest concentrations of trichloroethene in OU2 (12,000 μg/L in well 36-87BR)

30 Section 5.1.2.2, Page 5-15, Paragraph 4 If the soil sampling program presented in this section is intended to address the deficiencies in source characterization that have been noted throughout Section 2 0 of this document, the sampling program depicted in Figure 5-4 needs to be expanded within the three remedial investigation areas

The previous soil sampling program did not adequately characterize the vertical distribution of contaminants due to the large (9 to 12 feet of total depth) composite samples that were collected (refer to comments 5, 7, and 12) Therefore, vertical soil profiles should be excavated and sampled at sites immediately downgradient of all SWMUs at OU2 where radioactive materials have been stored or disposed These sampling locations should be identified in a figure

Furthermore, the sampling protocol described on page 5-15 will not be adequate to thoroughly assess the vertical distribution of plutonium 239 and 240, and americium 241 in the soil profile at the source areas The proposed 1 meter depth of sampling will not distinguish between surficial radionuclide contamination due to wind dispersal from the 903 Drum Storage Site, and radionuclide contamination due to leakage from buried drums (data provided in this workplan indicate that trenches were excavated to a 5-foot depth) The sampling protocol described in page 5-15 should be adequate for outlying (downwind) sampling locations

If geologic conditions preclude the use of trenching to sample vertical soil profiles a rough estimate of vertical radionuclide distribution may be provided by using gamma logs or scintillometers in boreholes This method provides a qualitative evaluation of radioactivity and should be used only when trenching is impractical

31 Section 5.1.2.3, Page 5-23, Paragraph 3. There should be a sediment sampling station downgradient from Pond C-2 This is important due to the plutonium concentrations given in Appendix D for station SED-25 (3.3± 0 1 pCi) which is upgradient of Pond C-2

32 Section 5.2.3, Page 5-30, Paragraph 2. This paragraph states that all samples other than organics, major ions, and tritium analyses will be filtered in the field. EPA's Resource Conservation and Recovery Act Ground-Water Monitoring Technical Enforcement Guidance Document (TEGD) suggests that ground water samples for metals analysis be split into filtered (0 45 microns) and non-filtered portions This is done because "particles which may be present in the well even after well evacuation procedures, may absorb or adsorb various ionic species to effectively lower the dissolved content in the well water "

33 Section 5.2.4, Page 5-30, Paragraph 3. It was requested in the RI Sampling Plan comments that the Phase II sampling plan specify the frequency of surface water and sediment sampling This has not been presented in the Phase II Field Sampling Plan

34 Appendix A, Soil Sampling Results - General Comments. All soil sampling data above detection limits should be presented in these tables, not just concentrations above the calculated tolerance intervals